CLAIMS

What is claimed is:

1. A physical layer device of an Ethernet network device, comprising:

a reconciliation device that includes a first interface that outputs data; and

a physical coding sublayer (PCS) device that communicates with said first interface and that includes an encoder that encodes said data to produce an encoded data block with n data blocks each including at least one of data portions, pointer portions, and control code portions, and wherein said encoder is capable of locating control code portions within any of said n data blocks.

2. The physical layer device of Claim 1 further comprising a multiplexer that aggregates data, which includes at least one of data portions and control portions, from m data streams received from said reconciliation device into a multiplexed data block.

3. The physical layer device of Claim 1 wherein said first interface is XGMII compliant.

4. The physical layer device of Claim 1 wherein said n data blocks in said encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

5. The physical layer device of Claim 1 wherein said pointer portions indicate whether additional control codes are present in said encoded data block.

6. The physical layer device of Claim 1 further comprising:

a scrambler that communicates with said encoder and that scrambles said encoded data block to produce a scrambled data block;

a sync adder that adds a sync header to said scrambled data block, wherein said sync header has a first state when said scrambled data block only includes said data portions, and wherein said sync header has a second state when said scrambled data block includes at least one of said control code portions.

7. The physical layer device of Claim 6 further comprising a serializer/deserializer (SERDES) that communicates with said scrambler.

8. The physical layer device of Claim 6 wherein said PCS module implements 64/66 bit encoding.

9. The physical layer device of Claim 1 wherein when one of said data portions occurs before a last one of said control code portions in said encoded data block, said one of said data portions is shifted relative to a block boundary in said encoded data block and wherein when one of said data portions occurs after a last one of said control code portions in said encoded data block, said one of said data portions is aligned with a block boundary in said encoded data block.

10. The physical layer device of Claim 6 further comprising:

a serializer/deserializer (SERDES) that communicates with said scrambler and that receives a first scrambled data block from said scrambler;

a descrambler that communicates with said SERDES that descrambles a second scrambled data block and that outputs a second encoded data block; and

a decoder that communicates with said descrambler and that decodes said second encoded data block.

11. A physical layer device of an Ethernet network device, comprising:

a serializer/deserializer that has an input and an output that outputs an encoded data block; and

a physical coding sublayer (PCS) device that communicates with said output and that includes a decoder that decodes said encoded data block, wherein said encoded data block includes n data blocks each including data portions, pointer portions, and control code portions, and wherein said control code portions can be located within any of said n data blocks.

12. The physical layer device of Claim 11 wherein said decoder reads a pointer portion of one of said n data blocks.

13. The physical layer device of Claim 12 wherein if said pointer portion of said one of said n data blocks points to said one of said n data blocks, said decoder reads said control code portion from said one of said n data blocks, and wherein if said pointer portion of said one of said n data blocks points to another of said n data blocks, said decoder reads a data portion overlapping said one of said n data blocks and an adjacent one of said n data blocks.

14. The physical layer device of Claim 12 wherein if said pointer portion of said one of said n data blocks indicates that there are no additional control

portions in said n data blocks, said decoder reads data portions from remaining ones of said n data blocks.

15. The physical layer device of Claim 11 further comprising:

a reconciliation device that includes a first interface that outputs data; and

an encoder that encodes said data to produce a first encoded data block that includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said encoder is capable of locating control code portions within any of said n data blocks.

16. The physical layer device of Claim 15 further comprising a multiplexer that aggregates said data, which includes at least one of data portions and control portions, from m data streams received from said reconciliation device into a multiplexed data block.

17. The physical layer device of Claim 15 wherein said first interface of said reconciliation device is XGMII compliant.

18. The physical layer device of Claim 15 wherein said n data blocks in said first encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

19. The physical layer device of Claim 15 further comprising:

a scrambler that scrambles said first encoded data block to produce a first scrambled data block; and

a sync adder that adds a sync header to said first scrambled data block.

20. The physical layer device of Claim 19 wherein said sync header has a first state when said scrambled data block only includes said data portions, and wherein said sync header has a second state when said scrambled data block includes at least one of said control code portions.

21. The physical layer device of Claim 15 wherein said PCS device implements 64/66 bit encoding.

22. The physical layer device of Claim 20 wherein when one of said data portions occurs before a last one of said control code portions in said first encoded data block, said one of said data portions is shifted relative to a block boundary in said first encoded data block, and wherein when one of said data portions occurs after a last one of said control code portions in said first encoded data block, said one of said data portions is aligned with a block boundary in said first encoded data block.

23. A physical coding sublayer (PCS) device of a physical layer device that includes a reconciliation sublayer and a serializer/deserializer (SERDES), comprising:

a transmit channel that encodes data received from the reconciliation sublayer and that transmits a first encoded data block to the SERDES, wherein said first encoded data block includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said control code portions can be located within any of said n data blocks of said first encoded data block; and

a receive channel that receives a second encoded data block from the SERDES and that decodes said second encoded data block, wherein said second encoded data block includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said control code portions can be located within any of said n data blocks of said second encoded data block.

24. The PCS device of Claim 23 wherein said transmit channel further comprises:

an encoder that communicates with the reconciliation sublayer; and

a scrambler that has an input that communicates with said encoder and an output that communicates with the SERDES.

25. The PCS device of Claim 23 wherein said receive channel further comprises:

a descrambler that has an input that communicates with the SERDES; and

a decoder that has an input that communicates with said descrambler device and an output that communicates with the reconciliation sublayer.

26. The PCS device of Claim 25 wherein said decoder reads a pointer portion of one of said n data blocks.

27. The PCS device of Claim 26 wherein if said pointer portion of said one of said n data blocks points to said one of said n data blocks, said decoder reads a control portion of said one of said n data blocks, and wherein if said pointer portion points to another of said n data blocks, said decoder reads a data portion overlapping said one of said n data blocks and an adjacent one of said n data blocks.

28. The PCS device of Claim 26 wherein if said pointer portion indicates that there is no additional control code data, said decoder reads data portions from remaining ones of said n data blocks.

29. The PCS device of Claim 24 wherein said transmit channel further comprises a multiplexer that aggregates data, which includes at least one of data portions and control portions, from m data streams received from the reconciliation sublayer into a multiplexed data block.

30. The PCS device of Claim 23 wherein said n data blocks in said first encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

31. The PCS device of Claim 23 wherein said pointer portions in said first encoded data block indicate whether additional control codes are present in said encoded data block.

32. The PCS device of Claim 30 wherein when one of said data portions occurs before a last one of said control code portions in said first encoded data block, said one of said data portions is shifted relative to a block boundary in said first encoded data block and wherein when one of said data portions occurs after a last one of said control code portions in said first encoded data block, said one of said data portions is aligned with a block boundary in said first encoded data block.

33. A physical layer device of an Ethernet network device, comprising:

reconciliation means for generating data at a first interface thereof; and

physical coding sublayer (PCS) means for communicating with said first interface and including encoding means for encoding said data to produce an encoded data block with n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said encoding means is capable of locating control code portions within any of said n data blocks.

34. The physical layer device of Claim 33 further comprising multiplexing means for aggregating data, which includes at least one of data portions and control portions, from m data streams received from said reconciliation means into a multiplexed data block.

35. The physical layer device of Claim 33 wherein said first interface is XGMII compliant.

36. The physical layer device of Claim 33 wherein said n data blocks in said encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

37. The physical layer device of Claim 33 wherein said pointer portions indicate whether additional control codes are present in said encoded data block.

38. The physical layer device of Claim 33 further comprising:

scrambling means that communicates with said encoding means for scrambling said encoded data block to produce a scrambled data block;

sync adding means for adding a sync header to said scrambled data block, wherein said sync header has a first state when said scrambled data block only includes said data portions, and wherein said sync header has a second state when said scrambled data block includes at least one of said control code portions.

39. The physical layer device of Claim 38 further comprising serializer/deserializer (SERDES) means for serializing and deserializing data and for communicating with said scrambling means.

40. The physical layer device of Claim 38 wherein said PCS means implements 64/66 bit encoding.

41. The physical layer device of Claim 33 wherein when one of said data portions occurs before a last one of said control code portions in said encoded data block, said one of said data portions is shifted relative to a block boundary in said encoded data block and wherein when one of said data portions occurs after a last one of said control code portions in said encoded data block, said one of said data portions is aligned with a block boundary in said encoded data block.

42. The physical layer device of Claim 38 further comprising:

serializer/deserializer (SERDES) means for serializing and deserializing data, for communicating with said scrambling means and for receiving a first scrambled data block from said scrambling means;

descrambling means that communicates with said SERDES means for descrambling a second scrambled data block and for generating a second encoded data block; and

decoding means that communicates with said descrambling means for decoding said second encoded data block.

43. A physical layer device of an Ethernet network device, comprising:

serializer/deserializer (SERDES) means for serializing and deserializing data and having an input and an output that outputs an encoded data block; and

physical coding sublayer (PCS) means for communicating with said output and including decoding means for decoding said encoded data block, wherein said encoded data block includes n data blocks each including data portions, pointer portions, and control code portions, and wherein said control code portions can be located within any of said n data blocks.

44. The physical layer device of Claim 43 wherein said decoding means reads a pointer portion of one of said n data blocks.

45. The physical layer device of Claim 44 wherein if said pointer portion of said one of said n data blocks points to said one of said n data blocks, said decoding means reads said control code portion from said one of said n data blocks, and wherein if said pointer portion of said one of said n data blocks points to another of said n data blocks, said decoding means reads a data portion overlapping said one of said n data blocks and an adjacent one of said n data blocks.

46. The physical layer device of Claim 44 wherein if said pointer portion of said one of said n data blocks indicates that there are no additional control portions in said n data blocks, said decoding means reads data portions from remaining ones of said n data blocks.

47. The physical layer device of Claim 43 further comprising:

reconciliation means for generating data at a first interface thereof; and

encoding means for encoding said data to produce a first encoded data block that includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said encoding means is capable of locating control code portions within any of said n data blocks.

48. The physical layer device of Claim 47 further comprising multiplexing means for aggregating said data, which includes at least one of data portions and control portions, from m data streams received from said reconciliation means into a multiplexed data block.

49. The physical layer device of Claim 47 wherein said first interface of said reconciliation means is XGMII compliant.

50. The physical layer device of Claim 47 wherein said n data blocks in said first encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

51. The physical layer device of Claim 47 further comprising:

scrambling means for scrambling said first encoded data block to produce a first scrambled data block; and

sync adding means for adding a sync header to said first scrambled data block.

52. The physical layer device of Claim 51 wherein said sync header has a first state when said scrambled data block only includes said data portions, and wherein said sync header has a second state when said scrambled data block includes at least one of said control code portions.

53. The physical layer device of Claim 47 wherein said PCS means implements 64/66 bit encoding.

54. The physical layer device of Claim 52 wherein when one of said data portions occurs before a last one of said control code portions in said first encoded data block, said one of said data portions is shifted relative to a block boundary in said first encoded data block, and wherein when one of said data portions occurs after a last one of said control code portions in said first encoded data block, said one of said data portions is aligned with a block boundary in said first encoded data block.

55. A physical coding sublayer (PCS) device of a physical layer device that includes a reconciliation sublayer and a serializer/deserializer (SERDES), comprising:

transmit means for encoding data received from the reconciliation sublayer and for transmitting a first encoded data block to the SERDES, wherein said first encoded data block includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said control code portions can be located within any of said n data blocks of said first encoded data block; and

receive means for receiving a second encoded data block from the SERDES and for decoding said second encoded data block, wherein said second encoded data block includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said control code portions can be located within any of said n data blocks of said second encoded data block.

56. The PCS device of Claim 55 wherein said transmit means further comprises:

encoding means for encoding said data received from the reconciliation sublayer; and

scrambling means for scrambling an output of said encoding means and having an output that communicates with the SERDES.

57. The PCS device of Claim 55 wherein said receive means further comprises:

descrambling means for descrambling said second encoded data from the SERDES; and

decoding means for decoding an output of said scrambling means and having an output that communicates with the reconciliation sublayer.

58. The PCS device of Claim 57 wherein said decoding means reads said pointer portion of one of said n data blocks.

59. The PCS device of Claim 58 wherein if said pointer portion of said one of said n data blocks points to said one of said n data blocks, said decoding means reads a control portion of said one of said n data blocks, and wherein if said pointer portion points to another of said n data blocks, said decoding means reads a data portion overlapping said one of said n data blocks and an adjacent one of said n data blocks.

60. The PCS device of Claim 58 wherein if said pointer portion indicates that there is no additional control code data, said decoding means reads data portions from remaining ones of said n data blocks.

61. The PCS device of Claim 56 wherein said transmit means further comprises multiplexing means for aggregating data, which includes at least one of data portions and control portions, from m data streams received from the reconciliation sublayer into a multiplexed data block.

62. The PCS device of Claim 55 wherein said n data blocks in said first encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

63. The PCS device of Claim 55 wherein said pointer portions in said first encoded data block indicate whether additional control codes are present in said encoded data block.

64. The PCS device of Claim 62 wherein when one of said data portions occurs before a last one of said control code portions in said first encoded data block, said one of said data portions is shifted relative to a block boundary in said first encoded data block and wherein when one of said data portions occurs after a last one of said control code portions in said first encoded data block, said one of said data portions is aligned with a block boundary in said first encoded data block.

65. A method for operating a physical coding sublayer of an Ethernet network device that receives data from a reconciliation sublayer, comprising:

encoding the data to produce an encoded data block with n data blocks each including at least one of data portions, pointer portions, and control code portions; and

selectively locating control code portions within any of said n data blocks.

66. The method of Claim 65 further comprising aggregating data, which includes at least one of data portions and control portions, from m data streams into a multiplexed data block.

67. The method of Claim 65 wherein said n data blocks in said encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

68. The method of Claim 65 further comprising using said pointer portions to indicate whether additional control codes are present in said encoded data block.

69. The method of Claim 65 further comprising:

scrambling said encoded data block to produce a scrambled data block; and

adding a sync header to said scrambled data block, wherein said sync header has a first state when said scrambled data block only includes said data portions, and wherein said sync header has a second state when said scrambled data block includes at least one of said control code portions.

70. The method of Claim 65 wherein when one of said data portions occurs before a last one of said control code portions in said encoded data block, said one of said data portions is shifted relative to a block boundary in said encoded data block and wherein when one of said data portions occurs after a last one of said control code portions in said encoded data block, said one of said data portions is aligned with a block boundary in said encoded data block.

71. A method of operating physical coding sublayer of an Ethernet network device that receives an encoded data block from a serializer/deserializer (SERDES), comprising:

receiving the encoded data block including n data blocks wherein said encoded data block includes n data blocks each including data portions, pointer portions, and control code portions, and wherein said control code portions can be located within any of said n data blocks; and

decoding said encoded data block.

72. The method of Claim 71 wherein said decoder reads said pointer portion in one of said n data blocks.

73. The method of Claim 72 further comprising:

reading said control code portion from said one of said n data blocks if said pointer portion of said one of said n data blocks points to said one of said n data blocks; and

reading a data portion overlapping said one of said n data blocks and an adjacent one of said n data blocks if said pointer portion of said one of said n data blocks points to another of said n data blocks.

74. The method of Claim 72 further comprising reading data portions from remaining ones of said n data blocks if said pointer portion of said one of said n data blocks indicates that there are no additional control portions in said n data blocks.

75. The method of Claim 71 further comprising:

encoding said data to produce a first encoded data block that includes n data blocks each including at least one of data portions, pointer portions, and control code portions; and

locating control code portions within any of said n data blocks.

76. The method of Claim 75 further comprising aggregating said data, which includes at least one of data portions and control portions, from m data streams received from said reconciliation device into a multiplexed data block.

77. The method of Claim 75 wherein said n data blocks in said first encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

78. The method of Claim 75 further comprising:

scrambling said first encoded data block to produce a first scrambled data block; and

adding a sync header to said first scrambled data block.

79. The method of Claim 78 wherein said sync header has a first state when said scrambled data block only includes said data portions, and wherein said sync header has a second state when said scrambled data block includes at least one of said control code portions.

80. The method of Claim 77 wherein when one of said data portions occurs before a last one of said control code portions in said first encoded data block, said one of said data portions is shifted relative to a block boundary in said

first encoded data block, and wherein when one of said data portions occurs after a last one of said control code portions in said first encoded data block, said one of said data portions is aligned with a block boundary in said first encoded data block.

81. A method for operating physical coding sublayer (PCS) of a physical layer device that receives data from a reconciliation sublayer and encoded data blocks from a serializer/deserializer (SERDES), comprising:

encoding the data received;

transmitting a first encoded data block, wherein said first encoded data block includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said control code portions can be located within any of said n data blocks of said first encoded data block;

receiving the second encoded data block; and

decoding said second encoded data block, wherein said second encoded data block includes n data blocks each including at least one of data portions, pointer portions, and control code portions, wherein said control code portions can be located within any of said n data blocks of said second encoded data block.

82. The method of Claim 81 further comprising reading said pointer portion of one of said n data blocks.

83. The method of Claim 82 further comprising:

reading a control portion of said one of said n data blocks if said pointer portion of said one of said n data blocks points to said one of said n data blocks; and

reading a data portion overlapping said one of said n data blocks and an adjacent one of said n data blocks if said pointer portion points to another of said n data blocks.

84. The method of Claim 82 further comprising reading data portions from remaining ones of said n data blocks if said pointer portion indicates that there is no additional control code data.

85. The method of Claim 81 further comprising aggregating data, which includes at least one of data portions and control portions, from m data streams received from the reconciliation sublayer into a multiplexed data block.

86. The method of Claim 81 wherein said n data blocks in said first encoded data block include one of:

one of said data portions;

one of said pointer portions and a first half of one of said data portions;

one of said pointer portions and one of said control code portions; and

a second half of one of said data portions and one of said control code portions.

87. The method of Claim 81 wherein said pointer portions in said first encoded data block indicate whether additional control codes are present in said encoded data block.

88. The method of Claim 86 wherein when one of said data portions occurs before a last one of said control code portions in said first encoded data block, said one of said data portions is shifted relative to a block boundary in said first encoded data block and wherein when one of said data portions occurs after a last one of said control code portions in said first encoded data block, said one of said data portions is aligned with a block boundary in said first encoded data block.